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Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE (9–1)

Time 1 hour 15 minutes

Paper reference **4BI1/2BR**

Biology

Unit: 4BI1
PAPER: 2BR

January 2022

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.

Information

- The total mark for this paper is 70.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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Answer ALL questions.

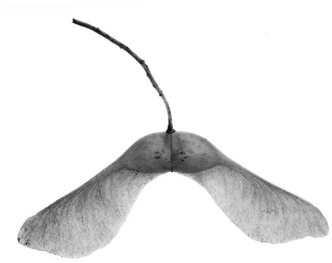
Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

Moving plants

Flowering plants reproduce using different methods to transfer the pollen from plant to plant. This cross-pollination enables plants to produce offspring that show genetic variation. The transfer can be done by animals such as insects or by wind.

The reliance on animals and wind for reproduction does not end with pollination. Flowering plants also need a mechanism to disperse their fruits or the seeds they contain. This seed dispersal means that seeds producing new young plants will germinate away from the parent plant.



wings on a sycamore

(Source: © joanna wnuk/Shutterstock)



fluff on a dandelion

(Source: © Viktorija Reuta/Shutterstock)



spines on burdock

(Source: © Paulpixs/Shutterstock)

The simplest method of seed dispersal uses gravity. The seeds are within heavy fruit, which fall from the tree when they are ripe. Although some of the fruit may roll away from the parent plant, most remain close to the parent plant.

Animal dispersal is when plants rely on animals to transport their seeds to a different area. This may be because the seeds are surrounded by a brightly-coloured and sweet-tasting fruit. Examples of this are soft fruits such as raspberry and hard fruits such as apple.

Animals may also carry seeds in a different way. Many plants produce fruits or individual seeds covered in hooks or spines that attach the seeds to the animals' fur. The seeds are then carried away from the parent plant. Eventually, the seeds may fall off, or be rubbed off by the animal. Examples of plants using this form of dispersal are burdock and sea holly.

Some plants provide seed pods with a mechanism that ejects the seeds from the pod by force. All of these rely on the effect of evaporation of water in the seed pod, so this method of seed dispersal usually takes place in sunlight. Examples of plants using this form of dispersal are gorse bushes and lupins.

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Wind is one of the main methods of seed dispersal. Some tall trees produce seed pods that have wings, which allow the seeds to travel long distances. Some seed pods have two wings such as the sycamore while others have one wing such as the ash.

There are also lightweight adaptations that help seeds to be blown by the wind. These include various sorts of fluff that increase the surface area of the seed, so that it can be picked up by the slightest breeze. Examples of plants using this form of dispersal are thistle and dandelion.

The last method uses water. Trees found on tropical beaches often have their seeds carried away by the sea. The seeds have woody, waterproof coverings enabling them to float in the water for long periods. Coconuts are a well-known example.

(a) Explain how cross-pollination can lead to an increase in genetic variation. (Lines 2–3)

(2)

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(b) (i) Explain the advantages of the seeds germinating away from the parent plant. (Line 8)

(3)

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(ii) Give one advantage of a seed germinating close to the parent plant. (Line 11)

(1)

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(c) Explain the conditions needed for seed germination.

(3)

(d) Explain why some seeds are surrounded by a brightly-coloured and sweet-tasting fruit. (Lines 13–14)

(2)

(e) Large numbers of tomato plants are often found growing along the sides of drains and settling beds on sewage farms.

Suggest a reason for this observation.

(1)

(f) Give the reason why sunlight is required for lupin seeds to be dispersed. (Lines 21–24)

(1)

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(g) Describe an experiment you could carry out to investigate how the presence of fluff on dandelion seeds affects how fast they fall. (Lines 30–31)

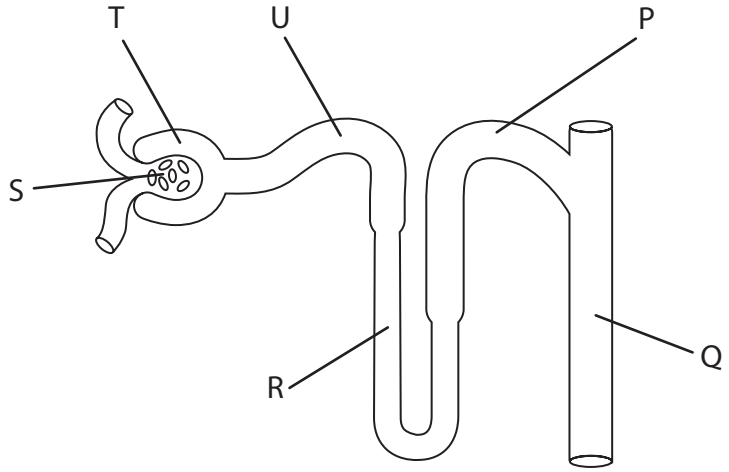
(3)

(Total for Question 1 = 16 marks)

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2 The diagram shows a nephron from a human kidney.



(a) (i) From which structure does ultrafiltration take place?

(1)

- ☒ **A** P
- ☒ **B** Q
- ☒ **C** R
- ☒ **D** S

(ii) From which structure is glucose reabsorbed?

(1)

- ☒ **A** Q
- ☒ **B** R
- ☒ **C** S
- ☒ **D** U

(iii) Which structure is the loop of Henle?

(1)

- ☒ **A** P
- ☒ **B** R
- ☒ **C** S
- ☒ **D** U

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(b) The table gives the mean values of mass filtered per day and excreted per day for different plasma components that are filtered and reabsorbed in the nephron.

Plasma component	Mass filtered per day in g	Mass excreted per day in g	Percentage reabsorbed
water	180 000	1800	99.0
sodium	630	3.0	99.5
glucose	180	0	100.0
urea	54		44.0

(i) State what is meant by plasma components.

(1)

.....

.....

(ii) Calculate the mean mass of urea excreted per day.

(2)

mean mass of urea = ... g

(iii) Explain why glucose is reabsorbed in the nephron.

(2)

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(iv) The concentration of urine is determined by the volume of water present and the mass of dissolved substances.

A person eats a meal with a high protein and salt content and drinks a small volume of water.

Comment on how this may change the values in the table and the effect it will have on urine production.

(5)

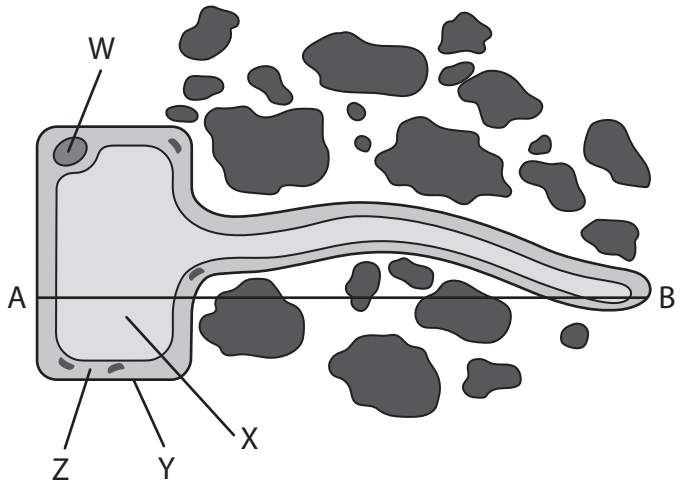
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3 The diagram shows a magnified image of a root hair cell from a young plant.



(a) Give the names of structures labelled W, X, Y and Z.

(4)

W .....

X .....

Y .....

Z .....

(b) The actual length of the cell, along the line between A and B, is 1000 μm.

Calculate the magnification of this drawing.

(2)

magnification = ...

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(c) (i) Explain the role of the root hair cell in absorption of water from the soil.

(3)

(ii) Sometimes gardeners give their plants too much water. The water fills up the air spaces in the soil around the plant roots.

Explain how this can lead to plants failing to grow properly.

(3)

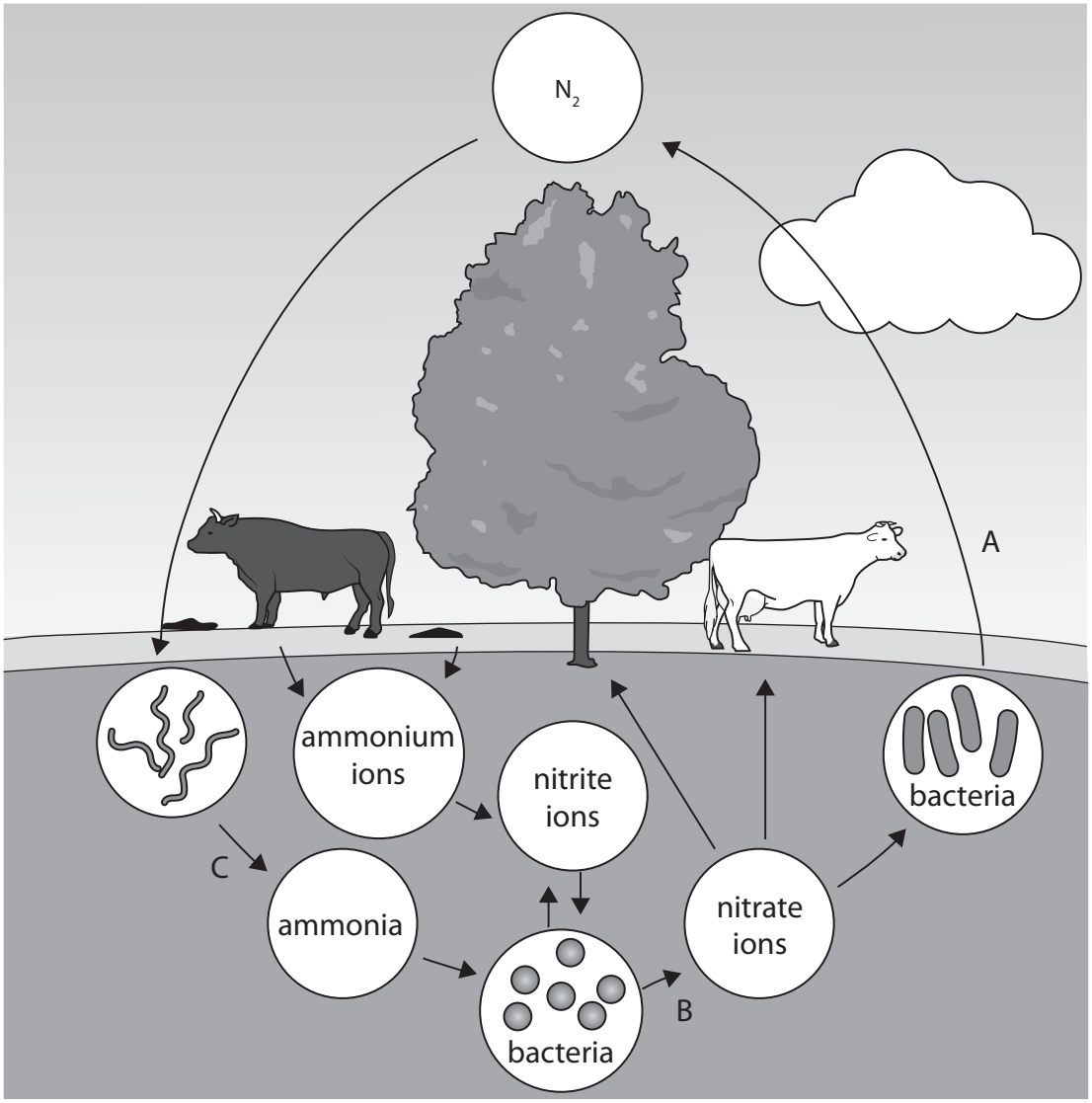
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4 The diagram shows some parts of the nitrogen cycle.



(a) Name the processes labelled A, B and C.

(3)

A .....

B .....

C .....

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(b) The mass of nitrogen that moves within the nitrogen cycle has been estimated and some of the masses are given in the table.

Process	Mass of nitrogen per year in $g \times 10^{12}$
released into atmosphere by burning of biomass	40
removed from atmosphere for manufacture of fertiliser	120
released into atmosphere by denitrification	100
removed from atmosphere by nitrogen fixation	58
removed from atmosphere by lightning	5
released into atmosphere in the form of ammonia	60
released into atmosphere as oxides of nitrogen	5
removed from atmosphere by deposition of oxides of nitrogen	70

(i) Some of these processes remove nitrogen from the atmosphere.

Calculate the total mass of nitrogen removed from the atmosphere by these processes.

Give your answer in standard form.

(2)

mass = ... g

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(ii) Calculate the percentage of the nitrogen released into the atmosphere that comes from burning of biomass.

(2)

percentage = ...

(iii) Explain how burning biomass returns nitrogen to the atmosphere.

(2)

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(c) Explain the effect of nitrous oxide on global warming.

(2)

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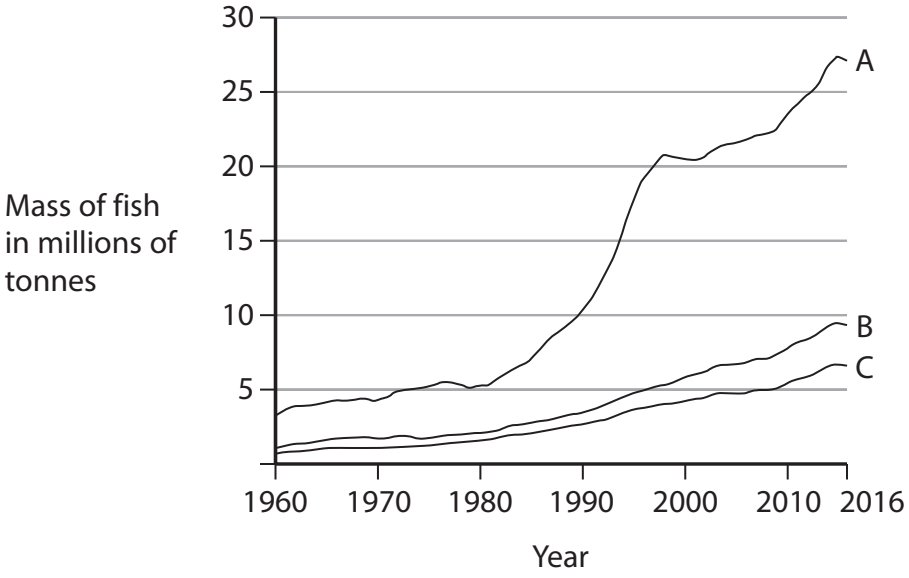
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(Total for Question 4 = 11 marks)

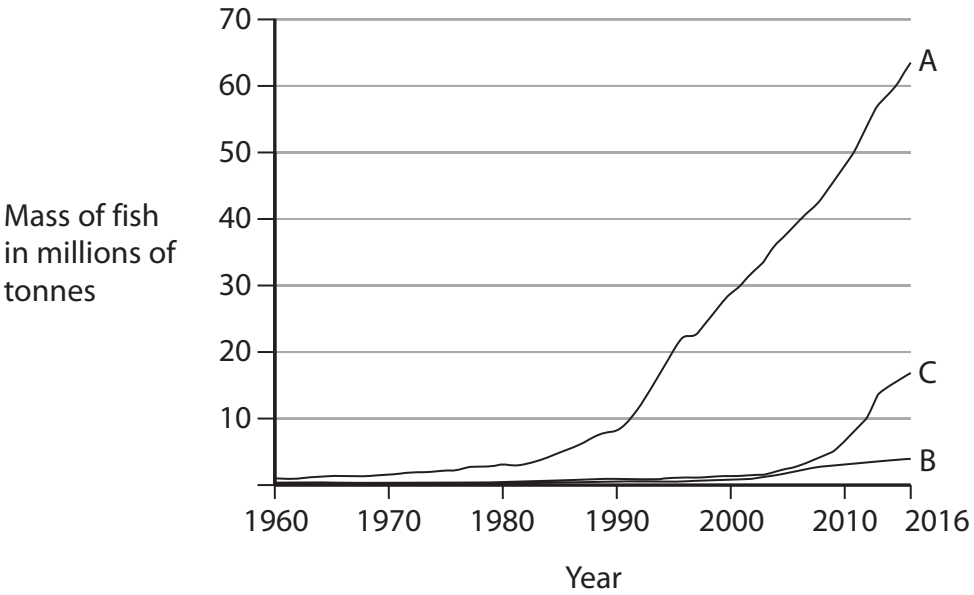
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5 Graph 1 shows the mass of fish caught by traditional fishing in tonnes from 1960 to 2016 in three countries.



Graph 1

Graph 2 shows the mass of fish produced by fish farming from 1960 to 2016 in the same three countries.



Graph 2

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(a) Comment on the changes in the mass of fish caught by traditional fishing and the mass of fish produced by fish farming from 1960 to 2016.

Use information from the graphs to support your answer.

(5)

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(b) Explain the methods a fish farmer can use to maximise production of fish.

(5)

(Total for Question 5 = 10 marks)

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6 A teacher carries out a demonstration to show the effect of different concentrations of salt solution on red blood cells.

This is the teacher's method.

- dilute a sample of blood using a salt solution that has the same concentration as blood plasma
- place 1 cm^3 of the diluted blood into each of three test tubes labelled A, B and C
- add 10 cm^3 of water to tube A
- add 10 cm^3 of 1% sodium chloride solution to tube B
- add 10 cm^3 of 5% sodium chloride solution to tube C
- leave each tube for 5 minutes
- compare the cloudiness of the solutions in the three test tubes
- take a drop of liquid from each tube and put on separate microscope slides
- observe each slide under a microscope

(a) State the independent variable in this investigation.

(1)

.....

(b) Give one variable that the teacher controls in this investigation.

(1)

.....

(c) After 5 minutes, these are the teacher's observations.

- tube A – a clear red solution
- tube B – a cloudy red suspension
- tube C – a cloudy red suspension

(i) Explain the differences in the teacher's observations.

(2)

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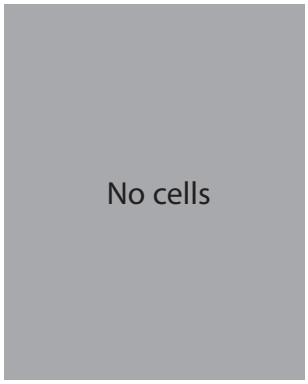
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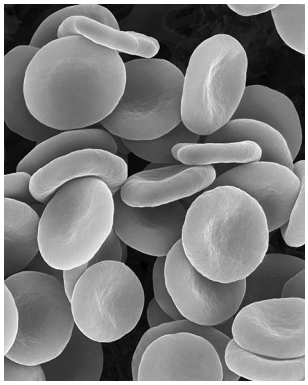
(ii) When the teacher looks down a microscope for cells on each slide, these are the teacher's observations.

- slide from tube A – no cells are seen
- slide from tube B – normal biconcave red cells are seen
- slide from tube C – red cells are seen but the cells have shrunken edges

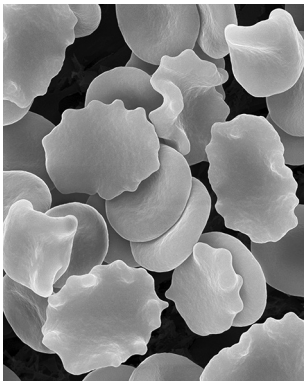
The photographs show the teacher's observations.



Tube A



Tube B



Tube C

(Source: © Dennis Kunkel Microscopy / Science Photo Library)

Explain the differences between the teacher's observations of the slides from each tube.

(2)

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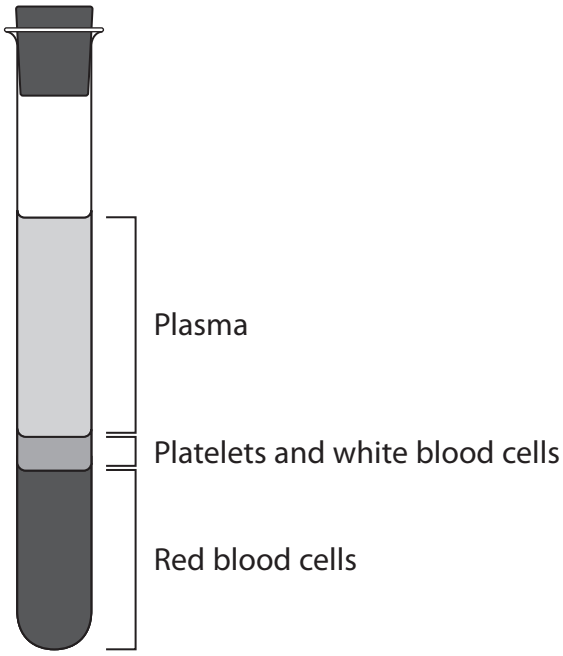
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(d) Blood samples can be separated into different layers using a centrifuge.

This is a machine that spins blood at a high speed.

A new sample of blood is shown after it has been spun in a centrifuge.



Describe how the blood in tubes A, B and C from the teacher's demonstration would look after they had been spun in a centrifuge.

(2)

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(Total for Question 6 = 8 marks)

TOTAL FOR PAPER = 70 MARKS

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